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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.,
Petitioner,

v.

TQ DELTA, LLC
Patent Owner

Case No. IPR2016-01009
Patent No. 8,238,412

PATENT OWNER'S NOTICE OF APPEAL

Pursuant to 35 U.S.C. §§ 141, 142, and 319, 37 C.F.R. §§ 90.2, 90.3, and 104.2, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner TQ Delta, LLC ("Patent Owner") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Decision Denying Patent Owner's Request for Rehearing (Paper 39) entered by the Patent Trial and Appeal Board on March 5, 2018 and the Final Written Decision (Paper 37) entered by the Patent Trial and Appeal Board on October 26, 2017, and all rulings leading up to those decisions.

In particular, and in accordance with 37 C.F.R. § 90.2(a)(3)(ii), Patent Owner identifies at least the following issues on appeal:

- The Board's finding that Claims 9-12, 15-18, and 21 of U.S. Patent No. 8,238,412 are unpatentable as obvious over Milbrandt, Chang, Hwang, and ANSI T1.413.
- The Board's claim construction; and
- Any Board finding, determination, judgment, or order supporting or related to the aforementioned issues as well as all other issues decided adversely to Patent Owner in any orders, decisions, ruling, and opinions.

Patent Owner is concurrently filing a copy of this Notice of Appeal with the Director of the United States Patent and Trademark Office and the Patent Trial and

Appeal Board, and a copy of the same, along with the required fees, with the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

Dated: May 7, 2018

/Peter J. McAndrews/

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Lead Counsel for Patent Owner

CERTIFICATE OF FILING

The undersigned hereby certifies that, in addition to being electronically filed through PTAB E2E, a true and correct copy of the above-captioned **NOTICE OF APPEAL** is being filed by hand with the Director on May 7, 2018, at the following address:

Director of the U.S. Patent & Trademark Office
c/o Office of the General Counsel, 10B20
Madison Building East
600 Dulany Street
Alexandria, VA 22314

The undersigned also hereby certifies that a true and correct copy of the above-captioned **NOTICE OF APPEAL** and the filing fee is being filed via CM/ECF with the Clerk's Office of the United States Court of Appeals for the Federal Circuit on May 7, 2018.

Dated: May 7, 2018

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that the foregoing **NOTICE OF APPEAL** was served electronically via email on May 7, 2018 in its entirety on the following:

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Paper No. 37
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.,
Petitioner,

v.

TQ DELTA, LLC,
Patent Owner.

Case IPR2016-01009
Patent 8,238,412 B2

Before SALLY C. MEDLEY, TREVOR M. JEFFERSON, and MATTHEW R. CLEMENTS, *Administrative Patent Judges*.

CLEMENTS, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

In this *inter partes* review, instituted pursuant to 35 U.S.C. § 314, Cisco Systems, Inc. ("Petitioner") challenges claims 9–12, 15–18, and 21 ("the challenged claims") of U.S. Patent No. 8,238,412 B2 (Ex. 1001, "the '412 patent"), owned by TQ Delta, LLC ("Patent Owner"). We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed below, Petitioner has shown by a preponderance of the evidence that the challenged claims are unpatentable. Patent Owner's Motion to Exclude is *dismissed*.

A. Procedural History

Petitioner filed a Petition requesting an *inter partes* review of claims 9–12, 15–18, and 21 of the '412 patent. Paper 2 ("Pet."). Patent Owner filed a corrected Preliminary Response. Paper 7. On November 4, 2016, we instituted *inter partes* review of claims 9–12, 15–18, and 21 of the '412 patent under 35 U.S.C. § 103(a) as obvious over Milbrandt,[1] Chang,[2] Hwang,[3] and ANSI T1.413.[4] Paper 8 ("Inst. Dec."), 30.

Thereafter, Patent Owner filed a Patent Owner Response (Paper 13, "PO Resp."), to which Petitioner filed a Reply (Paper 15, "Reply").

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[1] U.S. Patent No. 6,636,603 B1; issued Oct. 21, 2003 (Ex. 1011) ("Milbrandt").
[2] U.S. Patent No. 6,891,803 B1; issued May 10, 2005 (Ex. 1012) ("Chang").
[3] U.S. Patent No. 6,590,893 B1; issued July 8, 2003 (Ex. 1013) ("Hwang").
[4] *Network and Customer Installation Interfaces – Asymmetric Digital Subscriber Line (ADSL) Metallic Interface*, AMERICAN NATIONAL STANDARDS INSTITUTION (ANSI) T1.413-1995 STANDARD (Ex. 1014) ("ANSI T1.413").

Pursuant to an Order (Paper 19), Patent Owner filed a listing of alleged statements and evidence in connection with Petitioner's Reply that Patent Owner considered to be beyond the proper scope of a reply. Paper 20. Petitioner filed a response to Patent Owner's listing. Paper 24.

Patent Owner filed a Motion to Exclude (Paper 27), Petitioner filed an Opposition (Paper 31), and Patent Owner filed a Reply (Paper 34). Patent Owner also filed a Motion for Observation (Paper 29) to which Petitioner filed a Response (Paper 32).

We held a consolidated hearing on August 3, 2017, for this case and related Cases IPR2016-01006, IPR2016-01007, and IPR2016-01008, and a transcript of the hearing is included in the record. Paper 36 ("Tr.").

B. Related Proceedings

The parties indicate that the '412 patent is involved in the following district court cases: (1) *TQ Delta LLC v. Comcast Cable Communications LLC*, No. 1:15-cv-00611 (D. Del.); (2) *TQ Delta LLC v. CoxCom, LLC*, No. 1:15-cv-00612 (D. Del.); (3) *TQ Delta LLC v. DIRECTV*, No. 1:15-cv-00613 (D. Del.); (4) *TQ Delta LLC v. DISH Network Corp.*, No. 1:15-cv-00614 (D. Del.); (5) *TQ Delta LLC v. Time Warner Cable Inc.*, No. 1:15-cv-00615 (D. Del.); (6) *TQ Delta LLC v. Verizon Communications, Inc.*, No. 1:15-cv-00616 (D. Del.); (7) *ARRIS Group, Inc. v. TQ Delta LLC*, Case IPR2016-00430; (8) *Comcast Cable Communications, LLC v. TQ Delta, LLC*, Case IPR2017-00419; and (9) *DISH Networks, LLC v. TQ Delta, LLC*, Case IPR2017-00253. Paper 11, 1; Paper 6, 2–4. Patent Owner further identifies (1) *TQ Delta LLC v. 2Wire, Inc.*, No. 13-cv-1835 (D. Del.); (2) *TQ Delta LLC v. Zhone Technologies, Inc.*, No. 13-cv-1836 (D. Del.); (3) *TQ Delta LLC v. ZyXEL Communications, Inc. and ZyXEL Communications*

Corp., No. 13-cv-02013 (D. Del.); (4) *TQ Delta LLC v. ADTRAN, Inc.*, No. 1:14-cv-00954 (D. Del.); and (5) *ADTRAN, Inc. v. TQ Delta LLC*, No. 1:15-cv-00121 (D. Del.). Paper 6, 3–4. Also, Petitioner filed, concurrently with this Petition, a second petition challenging claims of the '412 patent, which became Case IPR2016-01008.

Petitioner also indicates that the '412 patent is related to U.S. Patent No. 8,432,956 B2 and U.S. Patent No. 7,835,430 B2, which are the subjects of IPR2016-00428 and IPR2016-00429, respectively. Pet. 1. U.S. Patent No. 8,432,956 B2 also is the subject of IPR2016-01007 and IPR2017-00422. U.S. Patent No. 7,835,430 B2 also is the subject of IPR2016-01006, IPR2017-00251, and IPR2017-00420.

C. The '412 patent (Ex. 1001)

The '412 patent discloses systems and methods for reliably exchanging diagnostic and test information between transceivers over a digital subscriber line in the presence of disturbances. Ex. 1001, 1:59–62. The systems and methods include the use of a diagnostic link mode in the communication of diagnostic information from a remote terminal (RT) transceiver or modem to the central office (CO) transceiver or modem, where either modem transmits a message to the other modem to enter diagnostic link mode. *Id.* at 2:60–64, 3:34–42. In diagnostic mode, the RT modem sends diagnostic and test information as bits to the CO modem. *Id.* at 3:48–53.

Figure 1 illustrates the additional modem components associated with the diagnostic link mode, and is reproduced below:

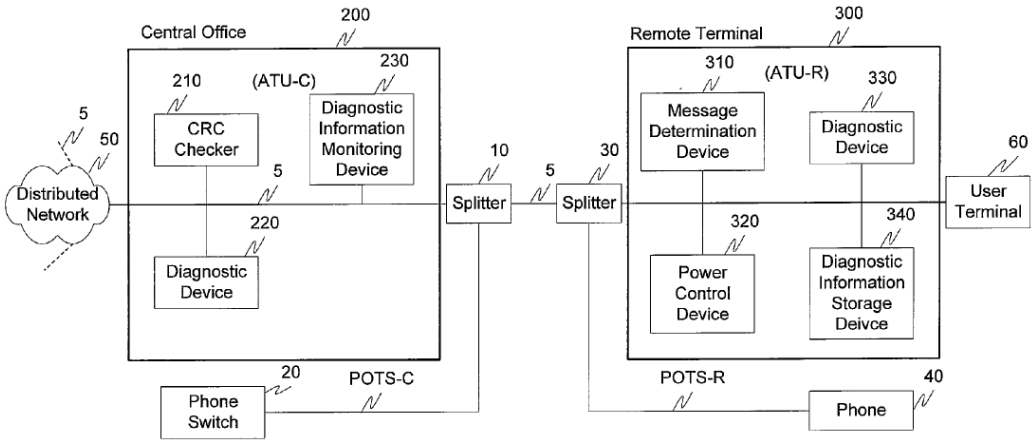


Fig. 1

Figure 1 illustrates a diagnostic mode system, where CO modem 200 and RT modem 300 are connected via link 5 to splitter 10 for a phone switch, and a splitter 30 for a phone 40. *Id.* at 4:58–5:5. CO modem 200 includes CRC checker 210, diagnostic device 220, and diagnostic information monitoring device 230. *Id.* RT modem includes message determination device 310, power control device 320, diagnostic device 330, and diagnostic information storage device 340. *Id.*

D. Illustrative Claims

Of the instituted claims, claims 9, 11, 15–18, and 21 are independent claims. Claims 10 and 12 depend from independent claims 9 and 11, respectively. Claims 15, 17, and 21 are illustrative of the claims at issue and are reproduced below:

> 15. One or more non-transitory computer-readable information storage media having stored thereon instructions that, if executed, cause a communications system for DSL service to perform a method comprising:
>
> transmitting a message from a first transceiver, wherein the message comprises one or more data variables that represent the test information, wherein bits in the message are modulated onto DMT symbols using Quadrature Amplitude Modulation

(QAM) with more than 1 bit per subchannel and wherein at least one data variable of the one or more data variables comprises an array representing Signal to Noise ratio per subchannel during Showtime information; and

receiving the message at a second transceiver, wherein the message comprises the one or more data variables that represent the test information, wherein the bits in the message were modulated onto the DMT symbols using Quadrature Amplitude Modulation (QAM) with more than 1 bit per subchannel and wherein the at least one data variable of the one or more data variables comprises the array representing Signal to Noise ratio per subchannel during Showtime information.

Ex. 1001, 10:40–61.

17. In a communications system for DSL service with a first DSL transceiver capable of transmitting test information over a communication channel using multicarrier modulation and a second DSL transceiver capable of receiving the test information over the communication channel using multicarrier modulation, a method comprising:

transmitting a message, wherein the message comprises one or more data variables that represent the test information, wherein bits in the message are modulated onto DMT symbols using Quadrature Amplitude Modulation (QAM) with more than 1 bit per subchannel and wherein at least one data variable of the one or more data variables comprises an array representing frequency domain received idle channel noise information; and

receiving the message, wherein the message comprises the one or more data variables that represent the test information, wherein the bits in the message were modulated onto the DMT symbols using Quadrature Amplitude Modulation (QAM) with more than 1 bit per subchannel and wherein the at least one data variable of the one or more data variables comprises the array representing frequency domain received idle channel noise information.

Ex. 1001, 11:19–41.

> 21. One or more non-transitory computer-readable information storage media having stored thereon instructions that, if executed, cause a communications system for DSL service to perform a method comprising:
>
> transmitting a message, wherein the message comprises one or more data variables that represent the test information, wherein bits in the message are modulated onto DMT symbols using Quadrature Amplitude Modulation (QAM) with more than 1 bit per subchannel and wherein at least one data variable of the one or more data variables comprises an array representing power level per subchannel information; and
>
> receiving the message, wherein the message comprises the one or more data variables that represent the test information, wherein the bits in the message were modulated onto DMT symbols using Quadrature Amplitude Modulation (QAM) with more than 1 bit per subchannel and wherein at least one data variable of the one or more data variables comprises an array representing power level per subchannel information

Ex. 1001, 12:44–63.

II. ANALYSIS

A. Claim Construction

The Board interprets claims of an unexpired patent using the broadest reasonable construction in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b); *see Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–46 (2016). Under the broadest reasonable construction standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

In our Decision on Institution, we adopted the following constructions:

Claim Term	Construction
frequency domain received idle channel noise information	information about the background noise present in each of a plurality of frequency subchannels when the subchannels are not in use
array	an ordered collection of multiple data items of the same type
transceiver	a device, such as a modem, with a transmitter and receiver

Dec. 7–9. Neither party has indicated that our interpretations were improper and we do not perceive any reason or evidence that now compels any deviation from our initial interpretations. Accordingly, based on the record developed during this proceeding, we continue to apply these constructions.

The parties dispute the meaning of "during Showtime" and "subchannel." PO Resp. 7–10; Reply 7–9. Accordingly, we construe those terms expressly.

1. "during Showtime"

In our Decision on Institution, we construed "during Showtime" to mean "during normal communications of an ANSI T1.413-compliant device." Inst. Dec. 8. Patent Owner argues that this construction (1) "could be incorrectly understood to cover modem initialization and training," and (2) neither the phrase "during Showtime" nor the claims of the '412 patent are limited to an "ANSI T1.413 compliant device." PO Resp. 7–8 (citing Ex. 2001 ¶ 31; Ex. 2005 (Declaration of Douglas Chrissan, Ph.D.)). According to Patent Owner, "during Showtime" should be construed to mean "during normal data communication that occurs after initialization." *Id.* at 9. Petitioner replies that, to the extent any revision is necessary, the testimony of Patent Owner's declarant, Dr. Chrissan, may be taken into account by construing "during Showtime" to mean "as "during normal

communications of a device compliant with the ANSI T1.413, ITU-T G.992.1, G.992.2, ADSL2, or VDSL2 communication standards." Reply 9.

Apart from the claims and Table 1, the '412 patent uses "during Showtime" only once. Ex. 1001, 3:33–34 ("during showtime, e.g., the normal steady state transmission mode"). There appears to be no dispute that "during Showtime" is intended to distinguish initialization and training. Pet. 14; PO Resp. 7; Reply 9; *see also* Tr. 21:19–23:11 (counsel for Petitioner). Moreover, both experts acknowledge that "during Showtime" is a term of art in DSL technology. Ex. 1009 ¶ 52; Ex. 1110 (deposition of Dr. Chrissan), 79:21–24. Although DSL is not recited in every challenged claim of the '412 patent, the Specification summarizes the invention as "systems and methods . . . directed toward reliably exchanging diagnostic and test information between transceivers over *a digital subscriber line* in the presence of voice communications and/or other disturbances." Ex. 1001, 1:59–62 (emphasis added). Accordingly, we determine that the broadest reasonable interpretation of "during Showtime" in the context of the '412 patent is "during normal communications of a DSL transceiver."

2. "subchannel"

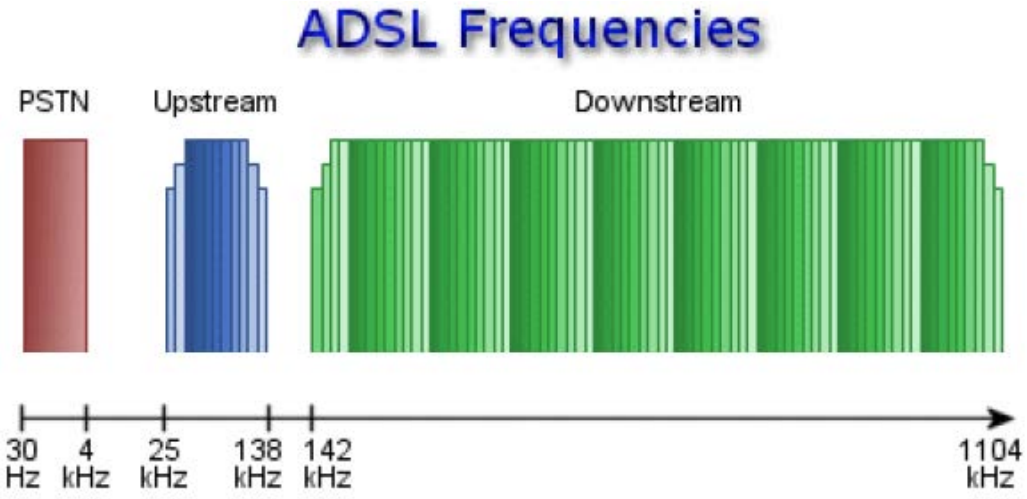
Patent Owner argues that "subchannel" should be construed to mean a "carrier of a multicarrier communication channel." PO Resp. 10. Patent Owner argues that "communication between ADSL transceivers 'is accomplished by modulating the data to be transmitted onto a multiplicity of discrete frequency carriers which are summed together and then transmitted over the subscriber loop. Individually, the carriers form *discrete, non-overlapping communication subchannels* of limited bandwidth.'" *Id.* (quoting Ex. 1001, 1:41–45 (emphasis added)).

Petitioner replies that this construction is overly narrow because the '412 patent elsewhere uses "subchannel" interchangeably with "tone," not just with "carrier." Reply 7–8 (citing Ex. 1001, 4:35–39; Ex. 1100 ¶ 6). Petitioner contends that a person of ordinary skill in the art would have understood "subchannel" to be equivalent and interchangeable with "channel," "carrier," "subcarrier," "band," "subband," and "tone." *Id.* (citing Ex. 1110, 43:13–49:15, 53:20–54:1). Petitioner's expert also testifies that "sub-frequency" would have been understood to be equivalent and interchangeable with "subchannel." *Id.* at 8 (citing Ex. 1100 ¶¶ 8–9). Petitioner also argues that Patent Owner's proposed interpretation is circular and confusing because it refers to both a "carrier" and a "channel," which Patent Owner's expert testified are equivalent terms. *Id.* (citing Ex. 1110, 53:20–54:1). Petitioner concludes that "subchannel" should be construed to mean "a portion of a frequency spectrum used for communication."

Apart from the claims and portion of column 1 cited by Patent Owner, the '412 patent uses "subchannels" only as follows:

> Individually, the carriers form discrete, non-overlapping communication subchannels of limited bandwidth.
>
> . . .
>
> Each modem includes a transmitter section for transmitting data and a receiver section for receiving data, and is of the discrete multitone type, i.e., the modem transmits *data over a multiplicity of subchannels* of limited bandwidth. Typically, the upstream or ATU-C modem transmits data to the downstream or ATU-R modem over *a first set of subchannels*, which are usually the higher-frequency subchannels, and receives data from the downstream or ATU-R modem over *a second, usually smaller, set of subchannels*, commonly the lower-frequency subchannels.

Ex. 1001, 1:44–2:16 (emphases added). This description is consistent with the following illustration provided by Patent Owner:



PO Resp. 16. Patent Owner contends that a "subchannel" is "the smallest division of the data transmission in a multicarrier communication system that uses DMT modulation," and gives, as examples, the 256 subchannels of ADSL1, the 512 subchannels of ADSL2+, and the 4096 subchannels of VDSL2. *Id.* at 15–16 (citing Ex. 2001 ¶¶ 38–39). Petitioner, likewise, contends a "subchannel" is "a discrete non-overlapping portion (e.g., one of 256 carriers) of a frequency spectrum . . . that uses DMT/QAM modulation for communication." Reply 13 (emphasis omitted). Both parties, therefore, appear to agree that a "subchannel" is a single carrier, such as one of the 256 carriers in ADSL1; they disagree, however, on the specific construction to be used.

Petitioner's proposed construction is overly broad because "a portion of a frequency spectrum used for communication" is not limited to one carrier. For example, "a portion of a frequency spectrum used for communication" could encompass the group of carriers used for upstream communication. Patent Owner's proposed construction, in contrast, is

limited to a single carrier. With respect to Petitioner's concern about Dr. Chrissan's testimony that "channel" and "carrier" are equivalent "in certain contexts" (Ex. 1110, 53:20–21), it is not clear that that testimony was in the context of DSL specifically. For the sake of clarity, however, we determine explicitly that a "subchannel" is a *single* carrier within a multicarrier communication system that, by definition, has a plurality of carriers.

Accordingly, we construe "subchannel" to mean "one of a plurality of carriers of a multicarrier communication channel."

B. Level of Ordinary Skill in the Art

Petitioner contends that a hypothetical person of ordinary skill in the art, with respect to and at the time of the'412 patent, would have, "(i) a Master's degree in Electrical and/or Computer Engineering, or equivalent training, and (ii) approximately five years of experience working in multicarrier telecommunications," and that a "[l]ack of work experience can be remedied by additional education, and vice versa." Pet. 13.

Patent Owner's expert, Dr. Chrissan, essentially agrees:

> [A] person of ordinary skill in the art would have an electrical engineering background and experience in the design of multicarrier communication systems, such as those employing OFDM or DMT modulation. More particularly, a person of skill in the art would be a person with a bachelor's degree in electrical engineering (or a similar technical degree or equivalent work experience) and at least three years of experience working with such multicarrier communication systems.

Ex. 2001 ¶ 34. We determine that the hypothetical person of ordinary skill in the art would have had either a Master's degree or a Bachelor's degree in electrical or computer engineering, and several years of experience working with multicarrier telecommunications. We note, however, that neither party

has explained substantively any significance that the difference in the proffered levels of ordinary skill in the art would play in the obviousness analysis. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) ("[T]he level of skill in the art is a prism or lens through which a judge, jury, or the Board views the prior art and the claimed invention."); *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991) ("The importance of resolving the level of ordinary skill in the art lies in the necessity of maintaining objectivity in the obviousness inquiry."). To that end, we note that, in this case, the prior art itself reflects an appropriate skill level. *See Okajima*, 261 F.3d at 1355.

C. The Parties' Post-Institution Arguments

In our Decision on Institution, we concluded that the arguments and evidence advanced by Petitioner demonstrated a reasonable likelihood that claims 9–12, 15–18, and 21 of the '412 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Milbrandt, Chang, Hwang, and ANSI T1.413. Inst. Dec. 30. We must now determine whether Petitioner has established by a preponderance of the evidence that the specified claims are unpatentable over the cited prior art. 35 U.S.C. § 316(e). We previously instructed Patent Owner that "any arguments for patentability not raised in the [Patent Owner Response] will be deemed waived." Paper 9, 6; *see also In re Nuvasive*, 842 F.3d 1376, 1379–82 (Fed. Cir. 2016) (holding Patent Owner waived argument addressed in Preliminary Response by not raising argument in the Patent Owner Response). Additionally, the Board's Trial Practice Guide states that the Patent Owner Response "should identify all the involved claims that are believed to be

patentable and state the basis for that belief." Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012).

With a complete record before us, we note that we have reviewed arguments and evidence advanced by Petitioner to support its unpatentability contentions where Patent Owner chose not to address certain limitations in its Patent Owner Response. In this regard, the record now contains persuasive, unrebutted arguments and evidence presented by Petitioner regarding the manner in which the asserted prior art teaches corresponding limitations of the claims against which that prior art is asserted. Based on the preponderance of the evidence before us, we conclude that the prior art identified by Petitioner teaches or suggests all uncontested limitations of the reviewed claims. The limitations that Patent Owner contests in the Patent Owner Response are addressed below.

D. Obviousness of Claims 9–12, 15–18, and 21 over Milbrandt, Chang, Hwang, and ANSI T1.413

Petitioner contends that claims 9–12, 15–18, and 21 of the '412 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Milbrandt, Chang, Hwang, and ANSI T1.413. Pet. 15–68.

1. Principles of Law

A claim is unpatentable under § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences

between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence, objective indicia of non-obviousness (i.e., secondary considerations). *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze this asserted ground based on obviousness with the principles identified above in mind.

2. Milbrandt Overview

Milbrandt discloses a system and method for determining the transmit power of a communication device operating on digital subscriber lines. Ex. 1011, 1:20–24. An example of the system is illustrated in Figure 1 as follows:

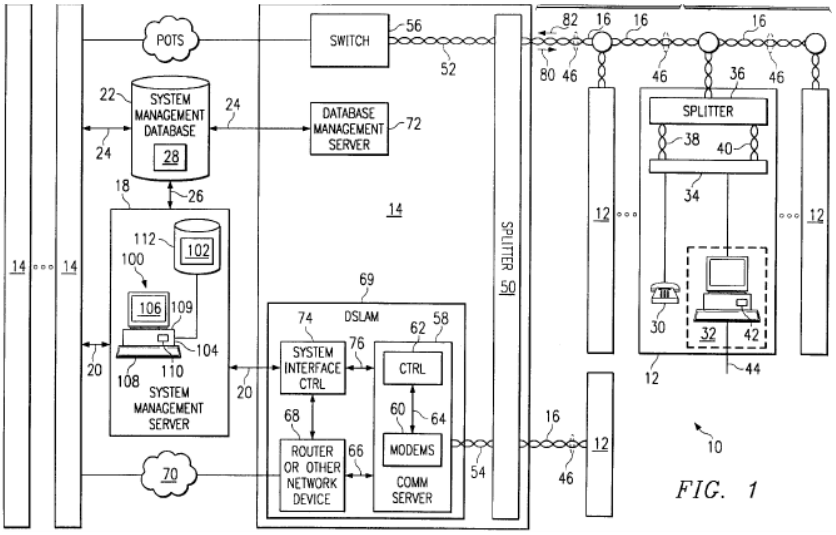


FIG. 1

Figure 1 illustrates a communication system that provides both telephone and data services. *Id.* at 4:4–5. Communication system 10 includes system management server 18 coupled to central offices 14, which are coupled to several subscribers' premises 12 using subscriber lines 16. *Id.* at 4:6–9. Database 22 stores subscriber line information 28 and communication device information 29 defining the physical and operating characteristics of the subscriber lines 16 and communication devices 60. *Id.* at 4:9–15. System

management server 18 determines the data rate capacity of selected subscriber lines 16 using subscriber line information 28 stored in database 22, and the optimal transmit power for a communication device operating on a subscriber line 16. *Id.* at 4:15–21.

Modem 42 at subscriber premises 12 receives the data signal communicated by modem 60 and determines the subscriber line information 28, such as attenuation information, noise information, received signal power spectrum density, or any other information describing the physical or operating characteristics of subscriber line 16 at the one or more sub-frequencies over which the connection between modem 60 and 42 is established. *Id.* at 11:38–45. Modem 42 extrapolates subscriber line information 28 to central office 14 over any achievable range of sub-frequencies using any suitable communication protocol. *Id.* at 4:45–53.

3. Chang Overview

Chang discloses a telecommunications transmission test set for testing digital communications networks. Ex. 1012, 1:7–9. One embodiment of the test set includes a light emitting diode (LED) display, a graphical display, a keypad, and an integrated microphone and speaker. *Id.* at 5:8–12. The system can further include a processor, a DMM (digital multimeter) test circuit, a TDR (time domain reflection) test circuit, and a transmission line impairment test circuit. *Id.* at 5:28–31, 5:58–60. The test circuits provide test signals or test tones, and perform test measurements for various line qualification tests. *Id.* at 5:60–63. The system further includes a modem module interface that receives data and control signals. *Id.* at 6:1–10. The test set performs both line qualification testing and connectivity testing to allow complete installation, maintenance, and repairs of a communications

network. *Id.* at 9:29–32

4. Hwang Overview

Hwang discloses an adaptive transmission system used in a network. Ex. 1013, 1:6–8. The system includes a computer network including network nodes capable of transmitting and receiving data over a channel using a transmitter and receiver. *Id.* at 5:1–8. The computer network utilizes discrete multi-tone (DMT) technology to transmit data over the channels. *Id.* at 5:12–14. A DMT-based system utilizes 256 tones, where each tone is capable of transmitting up to 15 bits of data on the tone waveform. *Id.* at 5:22–24. If a channel characteristics are poor and the receiving node is unable to receive the transmitted data without errors, the transmitting node is able to adapt the transmission rate to ensure error-free data is received. *Id.* at 7:3–7.

5. ANSI T1.413 Overview

ANSI T1.413 discloses electrical characteristics of Asymmetric Digital Subscriber Line (ADSL) signals appearing at a network interface. Ex. 1014, Abstract. ADSL allows for the provision of Plain Old Telephone Service (POTS) and a variety of digital channels. *Id.* at 1. Digital channels consist of full duplex low-speed channels and simplex high-speed channels in the direction from the network to the customer premises, and low-speed channels in the opposite direction. *Id.*

6. Petitioner's Initial Positions

Petitioner contends that a combination of Milbrandt, Chang, Hwang, and ANSI T1.413 would have rendered obvious claims 9–12, 15–18, and 21 of the '412 patent. Pet. 15–68. We have reviewed the Petition, Patent Owner's Response, and Petitioner's Reply, as well as the relevant evidence

discussed in those papers and other record papers, and are persuaded that the record sufficiently establishes Petitioner's contentions for claims 9–12, 15–18, and 21, and we adopt Petitioner's contentions discussed below as our own.

For example, the claim 21 preamble recites "[o]ne or more non-transitory computer-readable information storage media having stored thereon instructions that, if executed, cause a communications system for DSL service to perform a method." Petitioner argues that Milbrandt discloses a "communication system [] that provides both telephone and data services to subscribers" and a "communication device that transmits and receives data in [a] communication system [] using any suitable digital subscriber line technology (xDSL)." Pet. 42 (quoting Ex. 1011, 4:3–4, 4:64–67), 64 (citing Ex. 1009, 165) (emphasis omitted). Petitioner argues that Chang supplements Milbrandt because Chang discloses "a processor [] that controls the operation of modem module [] according to program instructions stored in a memory," where memory can be implemented as RAM, ROM, PROM, EPROM, FLASH memory, registers, or other memory devices. *Id.* at 30 (quoting Ex. 1012, 7:31–34; citing Ex. 1012, 7:40–46) (emphasis omitted). Petitioner argues that "[a] person of ordinary skill in the art would have understood that a ROM, a PROM, an EPROM, and FLASH are non-transitory computer readable memory since 'ROM' is an acronym for 'Read Only Memory.'" *Id.* (citing Ex. 1009, 107). We are persuaded by Petitioner's showing and find that a person of ordinary skill in the art would have understood that the devices of Milbrandt's DSL system, like modem 42, include a processor and program instructions that, if executed, cause the device to perform a method.

Petitioner argues that a person of ordinary skill in the art would have found it obvious to combine Milbrandt and Chang because both Milbrandt and Chang evaluate DSL communications and determine operational characteristics such as noise. Pet. 18–19 (citing Ex. 1011, 8:53–65, 9:31–34; Ex. 1012, 1:6–8, 2:59–61; Ex. 1009, 34). Petitioner explains that a person with ordinary skill in the art would have recognized the advantages of measuring background noise using Chang's techniques, where, for example, "when the system of Milbrandt updates the transmit power level for a device on one telephone line the impact on adjacent idle telephone lines within a binder group can be monitored using Chang's approach." *Id.* at 20. Petitioner further argues that "[t]hose of skill in the art would have understood that raising the transmit power level on a telephone line can improve [the] service quality by delivering a stronger signal to the far end." *Id.* at 19–20 (citing Ex. 1009, 37). Petitioner further provides several other advantages a person of ordinary skill in the art would have recognized as the benefits of combining Milbrandt and Chang. *See id.* at 20–23. As such, Petitioner argues, and we agree, that a person with ordinary skill in the art would have combined Milbrandt and Chang.

Claim 21 additionally recites "transmitting a message, wherein the message comprises one or more data variables that represent the test information." Petitioner argues that Milbrandt discloses this limitation. Pet. 31, 43, 64. Petitioner explains that Milbrandt discloses a "[m]odem [] comprises any suitable communication device [] that transmits and receives data." *Id.* at 31 (quoting Ex. 1011, 4:64–65) (emphasis omitted). Petitioner further argues that Milbrandt discloses "subscriber line information" that includes power spectrum density per sub-frequency S_f, attenuation

information per sub-frequency H_f, and noise information per sub-frequency N_f, and it would have been obvious to a person with ordinary skill in the art that these values represent "one or more data variables." *Id.* at 31–32 (citing Ex. 1011, 11:38–45; Ex. 1009, 56). We are persuaded by Petitioner's showing and find that Milbrandt's description of measured values of power spectrum density per sub-frequency S_f, noise information per sub-frequency N_f, and attenuation information per sub-frequency H_f meets the claim element of data variables that represent test information.

Claim 21 also recites "wherein bits in the message are modulated onto DMT symbols using Quadrature Amplitude Modulation (QAM) with more than 1 bit per subchannel." Petitioner argues that the combination of Milbrandt and Hwang disclose this limitation. *Id.* at 32–34, 65. Petitioner contends that Milbrandt discloses communication using DMT modulation, where "DMT technology divides a subscriber line into individual 'sub-bands or channels,' and 'uses a form of quadrature amplitude modulation (QAM) to transmit data in each channel simultaneously.'" *Id.* at 32–33 (quoting Ex. 1011, 11:60–64) (emphasis omitted). Petitioner argues that Hwang discloses that a "DMT signal is basically the sum of N independently quadrature amplitude modulated (QAM) signals, each carried over a distinct carrier frequency channel," and the ANSI standard provides for 256 carriers or tones, where "[e]ach tone is QAM to carry up to 15 bits of data on each cycle of the tone waveform (symbol)." *Id.* at 33 (quoting Ex. 1013, 2:67–3:12; citing Ex. 1009, 58) (emphasis omitted). Accordingly, Petitioner argues that Milbrandt discloses modulating bits using DMT and QAM, and Hwang discloses that DMT and QAM provide for transmission of up to 15 bits of data per subchannel. *Id.* We are persuaded by Petitioner's showing

and find that Milbrandt and Hwang describe using QAM to modulate bits onto DMT symbols.

Petitioner contends, with supporting evidence, that a "person of ordinary skill in the art would have found it obvious to combine the teachings of Milbrandt and Hwang because Hwang provides additional details of ADSL communication technology." Petitioner further contends that a person with ordinary skill in the art would "refer to all of their [Milbrandt, Chang, and Hwang] teachings in implementing an ADSL communication system for the purpose of obtaining a more complete understanding." Pet. 23–25. Petitioner argues that a person with ordinary skill in the art would have combined Hwang's teaching of using up to 15 bits for each subchannel with Milbrandt's communication system in order to transmit more data on each subchannel. *Id.* (citing Ex. 1009, 41). Petitioner also argues that a person would have been motivated to make such a combination in order to achieve a system that is "overall more efficient and has [a] higher throughput." *Id.* (citing Ex. 1009, 41). Accordingly, Petitioner argues that combining Hwang's known technique of using up to 15 bits per subchannel and Milbrandt's communication system renders nothing more than the predictable results of, for example, "transmitting data more efficiently, increasing throughput, improving service for customers, and making the system as [a] whole commercially desirable in the marketplace." *Id.* (citing Ex. 1009, 42). As such, Petitioner argues, and we agree, that a person with ordinary skill in the art would have combined Hwang with Milbrandt and Chang.

Claim 21 further recites "wherein at least one data variable of the one or more data variables comprises an array representing power level per

subchannel information." Petitioner argues that Milbrandt discloses this entire limitation (*see id.* at 34–37 (citing Ex. 1011, 11:19–24, 11:38–45, 12:14–31, 23:51–57, Fig. 3; Ex. 1009, 59–62; Ex. 1021, 126–127; Ex. 1022, 34)), 65 (citing Ex. 1009, 166)), except "Milbrandt does not expressly state that the information is *transmitted* as an array." *Id.* at 37. Milbrandt does disclose, according to Petitioner, "using ADSL techniques that comply with ANSI Standard T1.413." *Id.* (quoting Ex. 1011, 9:31–34). Petitioner argues that ANSI T1.413 discloses "transmitting data variables that have a value for a plurality of frequency sub-carriers." Petitioner argues that ANSI T1.413 discloses transmitting bit values and gain values "{b_1, g_1, b_2, g_2, [. . .] b_{255}, g_{255}}," where each available frequency sub-carrier has its own bit value and gain value. *Id.* (citing Ex. 1014, 110) (emphasis omitted). Petitioner further argues that a person with ordinary skill in the art would have "recognized that a frequency sub-carrier in the ANSI T1.413 standard corresponds to Milbrandt's sub-frequency, and that both of these terms correspond to the claimed 'sub-channel.'" *Id.* (citing Ex. 1009, 64). Accordingly, Petitioner contends that "it would have been obvious to a person of ordinary skill in the art to transmit Milbrandt's power spectrum density per sub-frequency and attenuation information per sub-frequency using the same array data format taught by ANSI T1.413. *Id.* at 37–38 (citing Ex. 1009, 64). We are persuaded by Petitioner's showing and find that it would have been obvious to a person having ordinary skill in the art to transmit Milbrandt's power spectrum density and attenuation information using the same array data format taught by ANSI T1.413, which would have resulted in the benefit of allowing the receiving modem to receive and access the information on a per

channel basis, without the need for additional processing or reordering of the received information.

Claim 21 additionally recites "receiving the message." Petitioner argues that Milbrandt discloses this limitation. Pet. 40, 47, 65. Petitioner explains that Milbrandt discloses a "[m]odem [] [comprises any suitable] 'communication device that transmits and receives data.'" *Id.* at 40 (quoting Ex. 1011, 6:46–49) (emphasis omitted). Claim 21 additionally recites the contents of the received message, which is the same contents of the transmitted message discussed above. Petitioner argues that it would have been obvious to a person with ordinary skill in the art, that the message transmitted by the subscriber modem of Milbrandt is the same message that is received by the central office modem. *Id.* at 38, 41–42, 46–47, 65–66 (citing Ex. 1009, 166). Accordingly, Petitioner provides the same analysis for the contents of the received message as presented for the contents of the transmitted message. *Id*. We are persuaded by Petitioner's showing and find that Milbrandt's modem 60 receives the message.

Petitioner argues that a person with ordinary skill in the art would have found it obvious to combine Milbrandt/Chang/Hwang with ANSI T1.413 because Milbrandt/Chang/Hwang describe communication systems, and ANSI T1.413 defines the ADSL communication standard. Pet. 25–29 (citing Ex. 1009, 42–43). Petitioner further argues that both Milbrandt and Hwang refer to the ADSL standard set forth by ANSI T1.413, and, therefore, a person with ordinary skill in the art would have been directed to combine the teachings of all three references. *Id.* at 26 (citing Ex. 1009, 43). Petitioner argues that it would have been advantageous to modify Milbrandt/Chang/Hwang with the teachings of ANSI T1.413 in order to

"improve signal quality and reliability," "adjust its automatic gain control . . . to an appropriate level," and "allow for interoperability with other devices that are ANSI T1.413 standard compliant, making the overall system more robust." *Id.* at 26–27 (citing Ex. 1009, 43–44). Specifically, Petitioner argues that

> a person of ordinary skill in the art would have recognized that transmitting per-subchannel data as an array, as taught by ANSI T1.413, would advantageously allowed the receiving modem to receive and access the information on a per sub-channel basis, without the need for additional processing or reordering of the received information.

Id. at 38. We are persuaded by Petitioner's showing and find that it would have been obvious to a person having ordinary skill in the art to transmit Milbrandt's power spectrum density and attenuation information using the same array data format taught by ANSI T1.413, which would have resulted in the benefit of allowing the receiving modem to receive and access the information on a per channel basis, without the need for additional processing or reordering of the received information.

Petitioner performs a similar analysis for claims 9–12 and 15–18. Pet. 29–64, 66–68. Notwithstanding Patent Owner's arguments, which we have considered and which we address below, we are persuaded by Petitioner's showing, which we adopt as our own findings and conclusions, that claims 9–12, 15–18, and 21 are unpatentable as obvious over Milbrandt, Chang, Hwang, and ANSI T1.413

7. Patent Owner's Assertions Concerning the References

Patent Owner argues that the challenged claims would not have been obvious over the combination of Milbrandt, Chang, Hwang, and ANSI

T1.413 for the following reasons: (1) the combination of references does not teach "power level per subchannel information," as recited in challenged claims 9–12 and 21 (PO Resp. 13–21); (2) the combination of references does not teach "power level per subchannel information . . . based on a Reverb signal," as recited in dependent claims 10 and 12 (*id.* at 21–25); (3) the combination of references does not teach "Signal to Noise ratio per subchannel during Showtime information," as recited in dependent claim 15 (*id.* at 25–32); and (4) the combination of references does not teach "idle channel noise," as recited in claims 16–18 (*id.* at 32–50). We address each argument in turn.[5]

a. "power level per subchannel information"(claims 9–12 and 21)

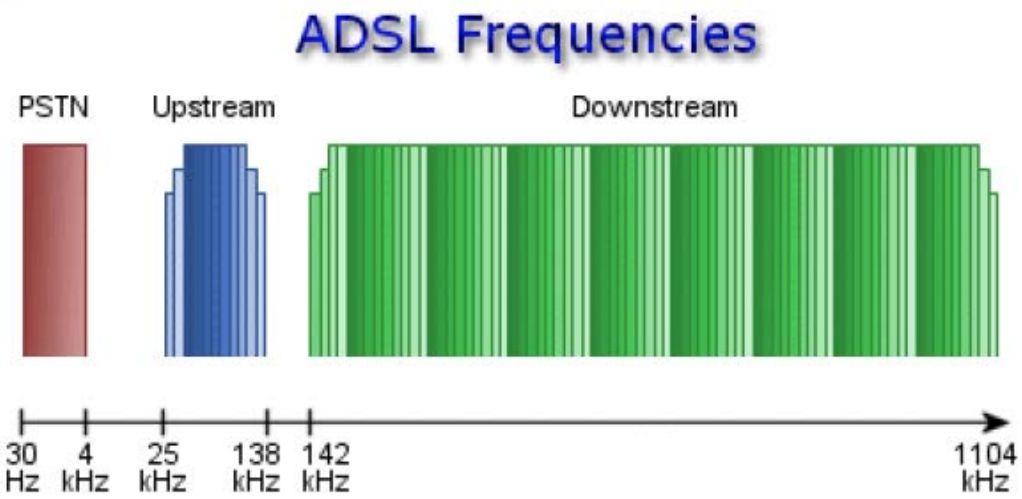
Claims 9–12 and 21 recite, in relevant part, "power level per subchannel information." Patent Owner presents three sub-arguments: (1)

[5] Patent Owner lists several portions of Petitioner's Reply and evidence allegedly beyond the scope of what can be considered appropriate for a reply. *See* Paper 20. We have considered Patent Owner's listing, but disagree that the cited portions of Petitioner's Reply and reply evidence are beyond the scope of what is appropriate for a reply. Replies are a vehicle for responding to arguments raised in a corresponding patent owner response. Petitioner's arguments and evidence that Patent Owner objects to (Paper 20, 1–2) are not beyond the proper scope of a reply because we find that they fairly respond to Patent Owner's arguments raised in Patent Owner's Response. *See Idemitsu, Kosan Co. v. SFC Co. Ltd.*, 870 F.3d 1376, 1381 (Fed. Cir. 2017) ("This back-and-forth shows that what Idemitsu characterizes as an argument raised 'too late' is simply the by-product of one party necessarily getting the last word. If anything, Idemitsu is the party that first raised this issue, by arguing—at least implicitly—that Arkane teaches away from non-energy-gap combinations. SFC simply countered, as it was entitled to do."). Nevertheless, we note that we do not rely on Exhibit 1109, cited in footnote 5 on page 28 of Petitioner's Reply.

Milbrandt's "sub-frequency" is not the recited "subchannel" (PO Resp. 14–18); (2) Milbrandt's "power spectrum density" and "attenuation" are aggregate values and, therefore, are not "per subchannel" (*id.* at 18–19); and (3) Milbrandt's power spectrum density and attenuation per sub-frequency do not "represent[]" power level per subchannel information (*id.* at 19–20). We address each in turn.

i. Whether Milbrandt's "sub-frequency" teaches the recited "subchannel"

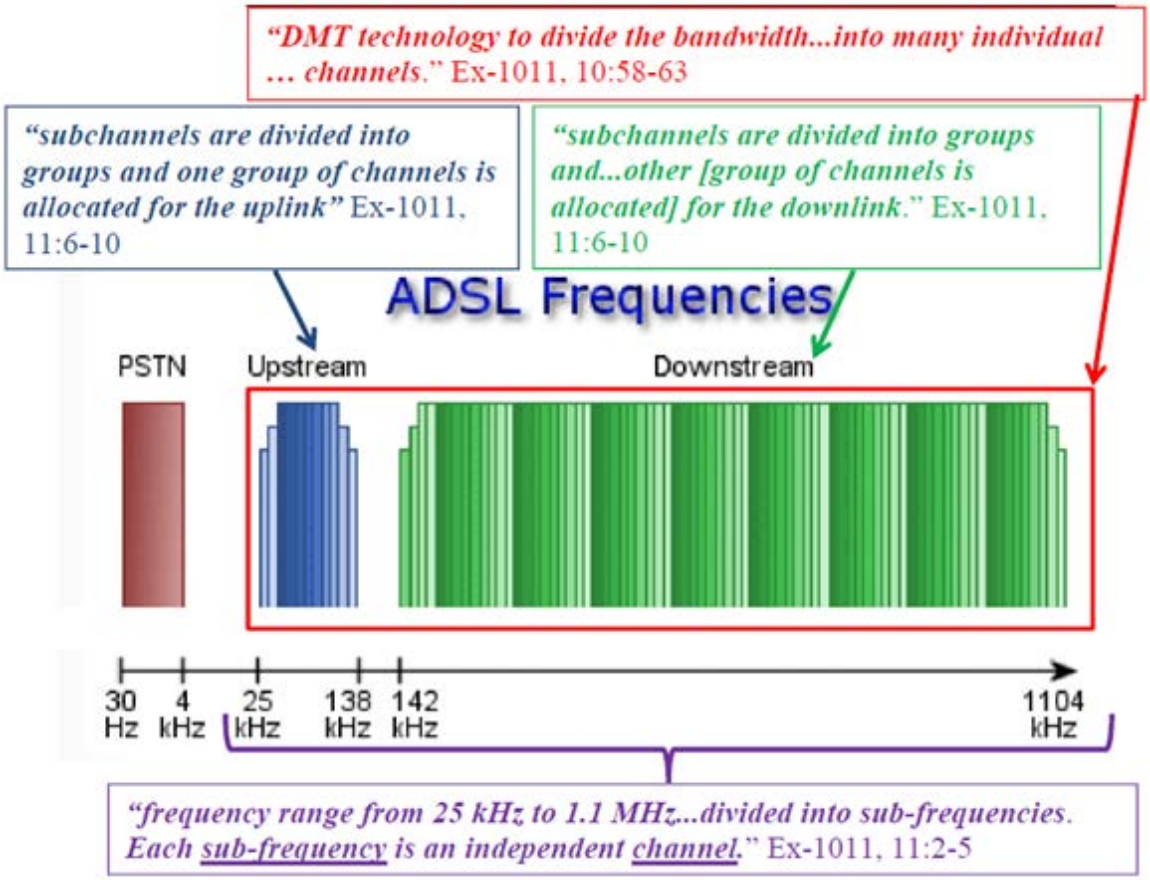
Patent Owner argues that Milbrandt's Power Spectrum Density ("PSD") and attenuation information per "sub-frequency," relied upon by Petitioner, are not the same as, or representative of, the recited "power level per subchannel information." PO Resp. 14. Specifically, Patent Owner argues that Milbrandt's "sub-frequency" is not the recited "subchannel." *Id.* at 14–18. Patent Owner illustrates the concept of "subchannels" with the following diagram:



Id. at 16. Patent Owner's diagram, titled "ADSL Frequencies," depicts a red column spanning from 30 Hz to 4 kHz shaded red for "PSTN," a plurality of blue columns between 25 kHz and 138 kHz for "Upstream," and a much

larger number of green columns between 142 kHz and 1104 kHz for "Downstream." According to Patent Owner, Milbrandt uses "sub-frequencies" to mean the group of carriers for downstream transmission or to mean the group of frequencies for upstream transmission, and uses "sub-channels" to mean a single carrier. *Id.* at 16–17. Patent Owner further contends that Milbrandt uses "sub-frequency" in the context of the V.90 protocol, which is not a multicarrier communication protocol and, therefore, cannot have any "subchannels" as the '412 patent uses that term. *Id.* at 15–16. Finally, Patent Owner contends that Figure 3 of Milbrandt depicts only six "frequency" columns, which is "far less than the hundreds of subchannels needed for multicarrier communication such as ADSL." *Id.* at 17.

Petitioner counters that Milbrandt uses the term "sub-frequencies" to mean the same thing as the recited "subchannels." Reply 10. Specifically, Petitioner contends that Milbrandt uses "channel" to refer to individual carriers, such as the 256 carriers of ADSL, on which QAM modulation is performed. *Id.* at 11 (citing Ex. 1011, 10:58–65). Petitioner further contends that Milbrandt uses "channel" and "sub-frequency" to refer to the same thing—i.e., an individual carrier. *Id.* at 12–13 (citing Ex. 1011, 11:2–10). According to Petitioner, Milbrandt uses "group of channels," not "sub-frequencies," to refer to the group of carriers used for upstream transmission and to the group of carriers used for downstream transmission, which shows that Milbrandt does not, as Patent Owner contends, use "sub-frequency" to mean "group of channels." Reply 12. Petitioner further illustrates Milbrandt's use of "channel" and "sub-frequency" with an annotated version of Patent Owner's figure, reproduced below.



Id. at 13. According to Petitioner, the annotated figure illustrates that Milbrandt uses "sub-frequency" and "channel" to "describe a ***discrete non-overlapping portion (e.g., one of 256 carriers)*** of a frequency spectrum from 25 kHz to 1.1 MHz that uses DMT/QAM modulation for communication." *Id.* Petitioner also argues that Milbrandt's uses of "sub-frequency" in the V.90 context to mean 0–4kHz frequency range used for voice communication is not inconsistent with its use of that term in the DSL context to mean an individual carrier in the multicarrier system and that a person of ordinary skill in the art would not have understood Figure 3 of Milbrandt to limit it to only six frequencies. *Id.* at 14.

We agree with Petitioner. Milbrandt states

> ADSL modems 60 increase the amount of data that the conventional twisted-pair subscriber lines 16 can carry by using DMT technology to divide the bandwidth of a subscriber line 16, generally referred to as the frequency spectrum supported by a subscriber line 16, into many individual *sub-bands or channels*. *Each channel* of a subscriber line 16 uses a form of quadrature amplitude modulation (QAM) to transmit data in each channel simultaneously. For example, the 1.1 MHz frequency spectrum of a conventional twisted pair subscriber line 16 may be divided such that the lower 4 kHz is reserved for use by POTS and is generally referred to as the voice frequency spectrum. The frequency range from 25 kHz to 1.1 MHz, generally referred to as the data frequency spectrum, is divided into *sub-frequencies*. *Each sub-frequency is an independent channel* and supports transmission of its own stream of data signals. DMT technology is very useful for ADSL technology where the sub-channels are divided into groups and one group *of channels* is allocated for the uplink transmission of data and the other for the downlink transmission of data.

Ex. 1011, 10:58–11:10 (emphases added). This description is consistent with the illustrations, reproduced above, from Patent Owner and Petitioner. Milbrandt states explicitly that "[e]ach sub-frequency is an independent channel" (*id.* at 11:4–5) and describes "channels" clearly as the individual carriers on which QAM is performed and which are grouped for upstream communication or downstream communication. Patent Owner's contention also is inconsistent with Milbrandt's description of downlink transmission as supported by "sub-frequencies" plural, rather than a "sub-frequency" singular, as would be appropriate if Patent Owner were correct. *See, e.g., id.* at 12:44–57.

Patent Owner's argument about V.90 also is not persuasive. It is not clear that Milbrandt is referring to more than one carrier even in the context

of the V.90 standard, and, even if it were, it would not imply Milbrandt uses "sub-frequency" to refer to more than one carrier in the context of a different—i.e., ADSL—standard. Reply 14.

We also are not persuaded by Patent Owner's contention that the six columns 344 of Figure 3 would be understood to correspond to "sub-frequencies associated with the various communication protocols supported by modem 42, rather than subchannels of a multicarrier communication channel (of which there may be hundreds)." PO Resp. 17–18 (quoting Ex. 2001 (Chrissan Decl.) ¶ 44). Neither Patent Owner nor Dr. Chrissan explain why, if that were the case, Figure 3 would depict six columns when ADSL, by Patent Owner's own explanation, should require only two columns—*one* for upstream and *one* for downstream. We are persuaded instead that Figure 3 is merely illustrating an example and that a person of ordinary skill in the art would have understood that, as even Dr. Chrissan acknowledges (Ex. 2001, ¶ 44 ("a person of skill in the art would not interpret this to mean exactly six columns") (emphasis omitted)).

We are persuaded that Milbrandt uses "sub-frequency" to refer to one carrier and not, as Patent Owner contends, a group of carriers. We are, thus, persuaded that Milbrandt's "sub-frequency" teaches the recited "subchannel."

ii. Whether Milbrandt's PSD and attenuation are "per subchannel"

Patent Owner argues that Milbrandt's PSD is an aggregate value—i.e., "a single value having the units of power per frequency, which indicates the average power level for an entire spectrum or band of frequencies"—and Milbrandt's attenuation is "one value for an entire spectrum or band of frequencies" and, therefore, neither represents a value "per subchannel." PO

Resp. 19 (citing Ex. 1011, 12:14–31; Ex. 1021; Ex. 2001 ¶¶ 47–48); *see also id.* at 20 ("Milbrandt's PSD and attenuation information indicate just the average power level over a wide swath of subchannels (several hundred or more).").

Petitioner counters that Milbrandt's "PSD per sub-frequency is representative of how much power the signal carries in that sub-frequency/subchannel." Reply 15 (citing Pet. 34; Ex. 1009 (Kiaei Decl.) 59, 65, 113). Specifically, Petitioner contends that the range of frequencies for which PSD is determined is the 4.3125 kHz range of a single sub-frequency/subchannel, *not* "an entire spectrum or band of frequencies," as Patent Owner contends (PO Resp. 19). Reply 15–16 (citing Ex. 1100 ¶ 30 ("Since it was known that ADSL subfrequencies have a frequency range of 4.3125 kHz, when Milbrandt's PSD is integrated for each sub-frequency across its respective range, the power level for that sub-frequency is obtained.").

We agree with Petitioner. Milbrandt describes transmitting power spectrum density at one or more sub-frequencies. Pet. 34 (citing Ex. 11:38–45). As an initial matter, we are persuaded that Milbrandt uses "sub-frequency" to mean the recited "subchannel" for the reasons just discussed. Both parties rely upon the formula for PSD at pages 126 to 127 of Exhibit 1021 (Pet. 35; PO Resp. 19; Reply 15), but they disagree about whether "unit bandwidth" refers to a single subchannel or multiple subchannels. Exhibit 1021 states, however, that "the PSD $S_g(\omega)$ represents the power per unit bandwidth (in hertz) of the spectral components at the frequency ω," (singular), not frequencies (plural), which supports Petitioner's contention that PSD represents power for a single subchannel.

iii. Whether Milbrandt's attenuation "represent[s] power level per subchannel"

In the Petition, Petitioner argued that, "[s]ince the attenuation information per sub-frequency is related to the power spectrum density per sub-frequency by the equation above, the attenuation information represents the power level per sub-frequency." Pet 35. Patent Owner argues that "'representing' is not arguably or reasonably the same thing as the term 'related to.'" PO Resp. 20 (citing Ex. 2002). Petitioner does not address this argument. *See* Reply 10–16. Because we are persuaded that Milbrandt's PSD "represent[s] power level per subchannel information" for the reasons discussed in the previous section, we need not determine whether Milbrandt's attenuation information, also relied upon by the Petitioner, "represent[s] power level per subchannel information."

For the foregoing reasons, we are persuaded that the combination of Milbrandt, Chang, Hwang, and ANSI T1.413 teaches "power level per subchannel information."

b. "power level per subchannel information . . . based on a Reverb signal" (claims 10 and 12)

Dependent claims 10 and 12 recite, in relevant part, "wherein the power level per subchannel information is based on a Reverb signal." In the Petition, Petitioner relied upon Milbrandt's teaching of determining PSD per subchannel in combination with ANSI T1.413's teaching to determine PSD based on measuring a REVERB signal. Pet. 66–68.

Patent Owner argues that "Petitioner only points to disclosure in ANSI" which "discloses that its PSD based on a Reverb signal is a single, aggregate value for the entire system, for all signals—not 'per subchannel.'" PO Resp. 22 (citing Ex. 1014, 94) (emphasis omitted). Petitioner counters

that it relies upon Milbrandt, not only ANSI T1.413, to teach PSD "per subchannel," and that it relies upon ANSI T1.413 for teaching determining PSD "based on a Reverb signal," which Patent Owner does not dispute is taught by ANSI T1.413. Reply 29–30 (citing Pet. 34–38, 53–54, 66–68).

Patent Owner's argument is not persuasive because Petitioner is relying upon the combination of the references. Nonobviousness cannot be established by attacking references individually where, as here, the ground of unpatentability is based upon the teachings of *a combination* of references. *In re Keller*, 642 F.2d 413, 426 (CCPA 1981). Rather, the test for obviousness is whether the combination of references, taken as a whole, would have suggested the patentee's invention to a person of ordinary skill in the art. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Here, we are persuaded that Milbrandt teaches PSD "per subchannel" for the reasons described in the previous section. Moreover, we are persuaded that ANSI T1.413 teaches calculating PSD "based on a Reverb signal" because it states "the ATU-C shall measure the aggregate received upstream power on sub-carriers 7 – 18 of R-REVERB1, and thereby calculate a downstream PSD." Ex. 1014, 94. Thus, the "downstream PSD" is "based on" the aggregate received upstream power on sub-carriers 7–18 of R-REVERB1.

With respect to the teaching in ANSI T1.413 relied upon by Petitioner, we note that it describes measuring an "aggregate" upstream power, but does not describe calculating an "aggregate" downstream PSD. The Reverb signal, therefore, is not "per subchannel," but that is not necessarily inconsistent with the claims, which include no such requirement. Moreover, we are persuaded by Petitioner's evidence that "aggregate" as used in ANSI T1.413 includes individual values for each of the

subchannels/sub-carriers in the same way that the '412 patent's Average Reverb Signal contains up to 256 entries. Reply 30 (citing Ex. 1100 (Kiaei Reply Decl.) ¶ 34; Ex. 1001, 4:34–35).

Patent Owner also argues that "Petitioner fail[s] to provide a credible reason for combining [ANSI T1.413's] alleged disclosure in this regard with Milbrandt's alleged disclosure of transmitting test messages." PO Resp. 23. Specifically, Patent Owner argues that reasons advanced by Petitioner—to "to adjust the gains to appropriate levels" (Pet. 16) and to "adjust the signal equalization" (Pet. 67)—are "based on a technological mischaracterization" because "is not what allows a subscriber modem to adjust its automatic gain control (AGC) to an appropriate level or adjust the signal equalization—it is the two specific Reverb signals themselves." PO Resp. 24 (emphases omitted); Ex. 2001 (Chrissan Decl.) ¶ 55.

Petitioner counters that Patent Owner's argument is "incorrect since the equalizer's function is to equalize power levels." Reply 31. Petitioner quotes the testimony of Dr. Chrissan that "one could use some notion of power" for training the equalizer and argues that PSD is such a "notion of power." *Id.* (quoting Ex. 1110, 99:4–20). Petitioner also argues that Dr. Chrissan did not affirmatively deny that the "notion of power" could be derived form a reverb signal. *Id.* at 32 (citing Ex. 1110, 100:6–15). Petitioner also argues that a person of ordinary skill in the art would have understood ANSI T1.413's teaching that "C-REVERB1 is a signal that allows the ATU-R receiver to adjust its automatic gain control (AGC) to an appropriate level" to include determining PSD based on that signal and using it to adjust gain, which is based on power. *Id.* at 32 (citing Ex. 1009, 119–20; Ex 1100 ¶ 37).

We are persuaded that Petitioner's reason to combine is credible. The Petition states:

> It would have been obvious to a person of ordinary skill in the art that to adjust the gains to an appropriate level and to adjust the signal equalization, it would be expedient for the receiving modem (Milbrandt's modem 42) to measure the power level on each subchannel. Ex. 1009, p.120. This is because the purpose of an equalizer in a multicarrier receiver is to adjust the frequency-dependent gain applied to the received signal so that the signal power level is approximately equal across all received frequencies. *Id*. In order to adjust the equalizer settings, therefore, the receiving modem would need to measure the relative power level of the received signal as a function of frequency (i.e., subchannel). *Id*.

Pet. 67–68. This is consistent with ANSI T1.413's teaching that "C-REVERB1 is a signal that allows the ATU-R receiver to adjust its automatic gain control (ACG) to an appropriate level." Ex. 1014, 94. This also is consistent with Dr. Kiaei's testimony that "[a person of ordinary skill in the art] would have understood that during training the REVERB signal, which is modulated for all the sub-carriers, is used to determine the power levels on each sub-carrier." Ex. 1009, 119. Although Dr. Chrissan testifies that "it is not the PSD information based on Reverb signals that allows a modem to adjust gain or adjust signal equalization—it is the Reverb signals themselves" (Ex. 2001 ¶ 55), he provides no explanation for how a modem would adjust gain or signal equalization *without* determining the power level or PSD of the received reverb signal. On this point, therefore, we credit the testimony of Dr. Kiaei that

> when [ANSI T1.413] states that the REVERB 'allows the ATU-R receiver to adjust its automatic gain control (ACG) to an appropriate level' it would have been understood that this includes determining PSD based on a REVERB signal and using

> that PSD to adjust the AGC. This is because the gain is based on power, which is represented by PSD.

Ex. 1100 ¶ 36; Reply 31–32 (quoting Dr. Kiaei's testimony).

For the foregoing reasons, we are persuaded that the combination of Milbrandt, Chang, Hwang, and ANSI T1.413 teaches "wherein the power level per subchannel information is based on a Reverb signal."

c. "Signal to Noise ratio per subchannel during Showtime information" (claim 15)

Independent claim 15 recites, in relevant part, "Signal to Noise ratio per subchannel during Showtime information." In the Petition, Petitioner relied upon, *inter alia*, Milbrandt's teaching that in order to "measur[e] noise characteristics of a subscriber line 16 during operation," the "modem 42 of a subscriber 12 may operate as a spectrum analyzer during operation." Ex. 1011, 12:58–63; Pet. 44.

Patent Owner argues that Milbrandt teaches gathering noise measurements during modem training, which is not "during Showtime." PO Resp. 27–28 (citing Ex. 1011, 10:41–46, 11:10–53). Petitioner counters that "[t]he Board already rejected this argument in its Decision on Institution," and that "TQ Delta presents no evidence to alter the Board's earlier determination." Reply 17. Petitioner, relying on Dr. Kiaei's testimony, argues that a person of ordinary skill in the art would have understood Milbrandt to measure noise information "during Showtime." *Id.* at 17–18 (citing Ex. 1100 ¶ 47). Petitioner also relies upon ANSI T1.413's teaching that SNR parameters are available "at any other time following the execution of initialization and training sequence of the ADSL system" (Ex. 1014, 103) and that "SNR, as measured by the receivers at . . . the ATU-R shall be

externally accessible from the ATU-C" (*id.* at 82), as confirmation that the information is measured "during Showtime." Reply 18.

We agree with Petitioner. Although the paragraph at column 11, lines 10 to 23, of Milbrandt begins "[d]uring modem training," Patent Owner does not explain how the content of that paragraph relates to the portion of Milbrandt relied upon by Petitioner, which is column 12, lines 58 to 63. Patent Owner similarly does not explain how the disclosure it highlights at column 10, lines 41 to 46, of Milbrandt is inconsistent with the disclosure relied upon by Petitioner. Even if they were related, Milbrandt appears to use the term "modem training" in an idiosyncratic manner. Both parties agree that "during Showtime" connotes normal communications of a DSL transceiver, which excludes initialization and training, as our construction of "during Showtime" reflects. Milbrandt, however, states "[m]odems 60 may collect information defining the operational characteristics of subscriber lines 16 *while providing data services to subscribers* 12. This process of gathering subscriber line information 28 is referred to as '*modem training*,' and generally occurs *during the normal course of operation* of system 10." Ex. 1011, 10:41–46 (emphases added). Although Milbrandt calls the process "training," which suggests it is not "during Showtime," Milbrandt simultaneously describes the process as occurring "during the normal course of operation" and "while providing data services to subscribers," which suggests it is "during Showtime." Because Milbrandt is, at best, ambiguous on this point, we are not persuaded that it is inconsistent with Milbrandt's otherwise clear teaching at column 12, lines 58 to 63.

Patent Owner also argues that ANSI T1.413 teaches only SNR margin, which is not the same thing as SNR. PO Resp. 28–29. Petitioner

counters that it relied upon not only ANSI T1.413's "signal-to-noise (SNR) margin test parameters" but also its "SNR, as measured," and that both "represent[] Signal to Noise ratio per subchannel during Showtime information," as recited in claims 13 and 14. Reply 17–18. Because Patent Owner argues only about SNR margin, Petitioner contends, it is undisputed that ANSI T1.413's measured SNR teaches the recited "Signal to Noise ratio information." *Id.* at 19. We agree. Even assuming that Patent Owner is correct about SNR margin, which we need not decide, we are persuaded by Petitioner's evidence that ANSI T1.413's teaching of "SNR, as measured by the receivers" and "externally accessible from the ATU-C" teaches the disputed limitation.

Finally, Patent Owner argues that "Petitioner provides no valid rationale for why it allegedly would have been obvious to transmit or receive that specific information in a multicarrier transceiver" (emphasis omitted) because Petitioner and Dr. Kiaei "fail to say how transmitting/receiving SNR would have facilitated system testing or improved signal quality or reliability." PO Resp. 29–30. Patent Owner also argues that the proffered reason makes no sense technologically because "the benefit that Petitioner claims one would realize by transmitting SNR in Milbrandt is nonexistent because Milbrandt already provided that benefit." *Id.* at 30–31.

Petitioner counters that the Petition explained that measuring SNR at the subscriber modem allows it to perform bit swapping to allocate bits on sub-carriers based on SNR. Reply 20–21 (citing Pet. 45 ("To determine how to spread the bits across the available subchannels (i.e., how many bits to transmit on each available subchannel), it would have been obvious to a person of ordinary skill in the art to measure the signal-to-noise ratio on a

per subchannel basis" (citing Ex. 1009, 131)); Ex. 1110 (Chrissan Depo.), 117:12–119:5). Also, according to Petitioner, it would have been obvious to include SNR calculated at the subscriber modem, as ANSI T1.413 teaches, among the "measured noise information" that Milbrandt teaches modem 42 communicating to modem 60 at the central office. *Id.* at 21–22.

We are persuaded that Petitioner has articulated a sufficient rationale, including at least Dr. Kiaei's testimony that a person of ordinary skill in the art would have understood that measuring SNR at the subscriber modem would provide at least the benefit of being able to "determine how to spread the bits across the available subchannels (i.e., how many bits to transmit on each available subchannel)." Ex. 1009, 131.

For the foregoing reasons, we are persuaded that the combination of Milbrandt, Chang, Hwang, and ANSI T1.413 teaches "Signal to Noise ratio per subchannel during Showtime information."

d. "Idle channel noise" (claims 16–18)

Patent Owner argues that the combined teachings of the references, in particular Milbrandt and Chang, do not render obvious transmitting (receiving) a test message comprising "idle channel noise information." PO Resp. 32–33. In particular, Patent Owner argues that (1) Milbrandt teaches away from using Chang's circuitry for measuring background noise (*id.* at 33–39); (2) Petitioner failed to establish a reasonable expectation of success in using Chang's concept of measuring background noise in some other manner (*id*. at 40–43); (3) incorporating Chang's background noise measurement would have improperly changed Milbrandt's fundamental principle of operation (*id*. at 43–45); and (4) adding any method of

measuring background noise to Milbrandt would have been redundant and unnecessary (*id*. at 46–50). We address each argument below.

i. Teaching Away

Patent Owner argues that Milbrandt teaches away from using Chang's circuitry for measuring background noise. PO Resp. 33–39 (citing "teaching away" case law regarding prior art teaching away from the *claimed invention*). Patent Owner argues that Petitioner only proposed combining Chang's actual physical equipment, which would require a visit from a technician or "truck roll,"[6] into Milbrandt's system, but that Milbrandt describes that a truck roll is undesirable. PO Resp. 35–38. We disagree. Although the Petition suggests combining Chang's background noise test circuitry with Milbrandt, the Petition argues that "Petitioner's combination permits, but does not require, physical incorporation of elements but rather that the combined teachings of the prior art as a whole would have rendered the claim[s] obvious." Pet. 23; *see also* Ex. 1009 ¶ 102. Patent Owner's view of Petitioner's position is too myopic. Because Patent Owner's entire teaching away argument is premised on the incorrect notion that Petitioner proposes only physically incorporating the entirety of Chang's testing arrangement which would necessitate using a "truck roll" into Milbrandt, the argument necessarily fails.

In addition, even assuming that Petitioner proposed only combining Chang's actual physical equipment, which would require a visit from a

[6] The parties use "truck roll" to mean a service technician visit. *See, e.g.*, PO Resp. 11 (citing Ex. 1011, 2:9–15 "dispatch of a service technician to install communication equipment or to configure the telephone line at the customer premises"); Pet. Reply 6.

technician or "truck roll," into Milbrandt's system, as Patent Owner alleges, we determine that Patent Owner's teaching away arguments still would not be persuasive and we disagree that Milbrandt would have discouraged a person of ordinary skill in the art from looking to the teachings of Chang.

A reference does not teach away if it merely expresses a general preference for an alternative invention but does not "criticize, discredit, or otherwise discourage" investigation into the *invention claimed*. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004) (emphasis added). Our reviewing court has recently held that "[e]vidence concerning whether the prior art teaches away from a given invention *must relate to and be commensurate in scope with the ultimate claims at issue*." *Idemitsu Kosan Co. v. SFC Co.*, 2016-2721, 2017 WL 4078964 *4 (September 15, 2017) (citing *MeadWestVaco Corp. v. Rexam Beauty and Closures, Inc.*, 731 F.3d 1258, 1264–1265 (Fed. Cir. 2013); *In re Kahn*, 441 F.3d 977, 990 (Fed. Cir. 2006); *In re Zhang*, 654 F. App'x 488, 490 (Fed. Cir. 2016) ("While a prior art reference may indicate that a particular combination is undesirable *for its own purposes, the reference can nevertheless teach that combination if it remains suitable for the claimed invention*.") (emphasis added).

The claims do not foreclose a "truck roll." For instance, claim 16 recites a transceiver capable of transmitting test information over a communication channel. Claim 16 further recites that the transceiver comprise a "transmitter portion capable of transmitting a message" where "the message comprises one or more data variables that represent the test information" and that at least one data variable "comprises an array representing frequency domain received idle channel noise information." Thus, claim 16 is directed to a transceiver and the type of message the

transceiver is capable of transmitting. There is nothing in claim 16 that specifies how the transceiver message originates or how the test information is measured. While we agree with Patent Owner that the Specification of the '412 patent describes that dispatching a technician to a remote site to perform testing, e.g., a "truck roll," is time consuming and expensive (PO Resp. 35 (citing Ex. 1001, 1:36–37)), we find that there are described embodiments of the invention that include a truck roll. Ex. 1001, 6:43–48 ("If the CRC checker 210 does not determine a correct CRC at the maximum power level and the diagnostic link mode [cannot] be initiated then other methods for determining diagnostic information are utilized, *such as dispatching a technician to the remote site*, or the like.") and 3:27–30 ("[t]he systems and methods of this invention can *enter the diagnostic link mode manually*, for example, *at the direction of a technician* or a user after completing a portion of initialization."). For these reasons, the claimed invention does not preclude a truck roll. In any event, as discussed above, the claims are not directed to how test information is obtained or measured. Accordingly, even if Patent Owner is correct that Milbrandt discourages a truck roll *for its own purposes*, we find the combined teachings of Milbrandt and Chang are relevant because the combination remains suitable for the *claimed invention*.

ii. Reasonable Expectation of Success

Patent Owner argues that even if Petitioner had proposed incorporating Chang's teaching of measuring background noise into Milbrandt without using Chang's physical equipment, Petitioner failed to show any reasonable expectation of success in doing so. PO Resp. 40–43. Patent Owner also argues that Petitioner failed to address, or present any

evidence, to show that a person having ordinary skill in the art would have known how to combine Chang with Milbrandt without a technician visit or truck roll. *Id*. at 42. We are not persuaded by Patent Owner's arguments.

Petitioner relies on Milbrandt for teaching transmitting test information (message) over subscriber lines. Thus, a person having ordinary skill in the art at the time of the invention knew how to transmit, and thus, receive or obtain, test information without a truck roll. Ex. 1011, 11:38–45. Petitioner relies on Chang for its teaching of transmitting a particular kind of test information. Petitioner explains, with supporting evidence, why a person having ordinary skill in the art would have wanted to include Chang's type of test information in the information transmitted by Milbrandt's system. In particular, Petitioner argues that measurements of idle channel noise information represent noise, such as thermal noise, cross talk, and impulse noise. Pet. 18–19 (citing Ex. 1020, 109). Petitioner further argues that such noises are independent of data signals transmitted on a subscriber line and are most readily and directly measured when there are no data signals on the line. Pet. 19 (citing Ex. 1009, 34). Petitioner concludes that it would have been obvious to a person having ordinary skill in the art at the time of the invention to combine the teachings of Chang with those of Milbrandt for the purpose of assessing interactions from other sources, including thermal effect, inductive coupling, and power spikes so as to take appropriate remedial measures to minimize system interactions and to address the noise source. Pet. 20–21 (citing Ex. 1009, 37–38), 56 (citing Ex. 1009, 38). Based on the record before us, that was all that was required from Petitioner.

We disagree with Patent Owner (PO Resp. 42) that Petitioner needed to provide technical details for how a person of ordinary skill in the art would have measured idle channel noise information and transmitted that information using Milbrandt's system, e.g., without a truck roll. In making its arguments, Patent Owner fails to take into account the level of skill that a person of ordinary skill would have had in this art. The involved patent itself does not provide specific details on how to measure idle channel noise information, indicating that at the time of the invention, measuring idle channel noise, with or without a truck roll, would be within the skill set of a person of ordinary skill in the art. Moreover, Petitioner persuasively argues that both experts agree that a person having ordinary skill in the art would have known how to measure idle channel noise information without a truck roll. Reply 24 (citing Ex. 1100 ¶¶ 73–74; Ex. 1110, 136:4–137:9); *see also* Reply 23; Ex. 1100 ¶¶ 76–77 (explaining that a person having ordinary skill in the art would have known how to include Chang's circuitry in Milbrandt's modem). For all of the above reasons, we are not persuaded by Patent Owner's arguments.

iii. Improperly Changing Milbrandt's Principle of Operation

Patent Owner argues that Chang's background noise measurement is incompatible with the purpose of Milbrandt's transmitted test information. PO Resp. 43–45. Patent Owner argues that because Chang teaches terminating a line in order to measure background noise (idle channel noise), that that teaching is incompatible with transmitting the same parameter over the line from one modem to another modem. *Id*. at 43–44 (citing Ex. 2001 ¶ 81). We are not persuaded by Patent Owner's arguments. First, Patent

Owner's arguments are premised on the notion that Petitioner proposes a total incorporation of Chang into Milbrandt's system, which for reasons discussed above are not persuasive. Second, Patent Owner's arguments are not particularly relevant to the claimed invention, as none of the claims are directed to how test information is obtained or measured. The claims are directed only to the kind of test information transmitted (or received).

In addition, Patent Owner's arguments are misplaced. A person having ordinary skill in the art at the time of the invention would have understood that idle channel noise is obtained during idle times, when the subchannel is not in operation. Ex. 1009 ¶¶ 48, 95; Ex. 1110, 133:12–134:15. Thus, Patent Owner's argument that "there is simply no compatible way to incorporate Chang's background noise measurement as a transmitted test measurement in Milbrandt" is misplaced because it assumes that the transmission of the resultant measurement would be done at the same time that all other measurements are taken and transmitted, e.g., when the subchannel is in operation. PO Resp. 44. Dr. Kiaei testifies that a person having ordinary skill in the art would have understood that idle channel noise measurement would be performed either during initialization or during periods when the modem is idle, and "that after the idle channel/background noise measurement completes, signals can continue to be transmitted from the remote modem to the central office modem in accordance with Milbrandt's teachings." Ex. 1100 ¶ 82. Dr. Chrissan's testimony on the matter (Ex. 2001 ¶ 81) is based on bodily incorporating Chang into Milbrandt without considering what the combined teachings of Chang and Milbrandt would have suggested to a person having ordinary skill in the art. *In re Keller*, 642 F.2d 413, 425 (Fed. Cir. 1981). Accordingly, we are not

persuaded by Patent Owner's arguments that Chang is incompatible with Milbrandt.

iv. Adding Chang's Teachings to Milbrandt would have been Unnecessary

Patent Owner argues that Milbrandt "was already able to do all of the same things that Petitioners claim would have been beneficial by using total noise measurements rather than background noise." PO Resp. 46. Patent Owner's arguments are not persuasive.

Petitioner argues, in the Petition, that a person having ordinary skill in the art would have recognized that it is important to measure and evaluate noise present on the subscriber line when the subchannel is not in operation for assessing interactions from other sources and to take remedial measures to address the noise source. Pet. 55–56; Ex. 1009 ¶¶ 48, 95. Petitioner also gives examples of the type of background noise that may be present. Pet. 19; Ex. 1009 ¶ 95; Ex. 1017, 613; Ex. 1020, 109. Petitioner further explains that background noise sources are independent of data signals transmitted on a subscriber line and that the time to measure idle noise is when no data signals are transmitted on the line. Pet. 19; Ex. 1009 ¶ 95.

In its Response, Patent Owner makes the assumption that Petitioner's arguments as to benefit and desirability for measuring background noise only amounts to *increasing signal strength* as a remedial measure in response to the degree of such noise in Chang, because the type of noise is not determinable. PO Resp. 47–48 (citing Ex. 2001 ¶¶ 82–83). As Petitioner points out, however, measuring noise without transmitting a signal from a transceiver over a subscriber line eliminates possible sources of noise, e.g., the transceiver, and, thus would be beneficial for assessing

system interactions and the source of noise. Pet. 56; Pet. Reply 26–27 (citing Ex. 1100 ¶¶ 85–89). Thus, we disagree that there would be no benefit of measuring background noise. We find that measuring background noise would have provided a person having ordinary skill in the art a more complete picture of the origin of the noise. Ex. 1100 ¶¶ 85–89, 91; Ex. 1110, 134:8–15.

8. Weight to be Given to Dr. Kiaei's Declaration

Patent Owner argues that no weight should be given to Dr. Kiaei's declaration because he lacks knowledge about basic concepts at issue in the proceeding. PO Resp. 50–52. In support of the argument, Patent Owner directs attention to portions of Dr. Kiaei's cross examination testimony where he allegedly (1) paused too long when answering a few questions, (2) was unfamiliar with certain terms or concepts, and (3) was incorrect from a technological standpoint. *Id*.

We have reviewed the arguments provided by Patent Owner and determine such arguments are insufficient to have Dr. Kiaei's declaration excluded in its entirety. Rather, it is within our discretion to assign the appropriate weight to be accorded evidence. *See* 37 C.F.R. § 42.65(a); *see also, e.g.*, *Yorkey v. Diab*, 601 F.3d 1279, 1284 (Fed. Cir. 2010) (holding the Board has discretion to give more weight to one item of evidence over another "unless no reasonable trier of fact could have done so"); *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1368 (Fed. Cir. 2004) ("[T]he Board is entitled to weigh the declarations and conclude that the lack of factual corroboration warrants discounting the opinions expressed in the declarations."); *Velander v. Garner*, 348 F.3d 1359, 1371 (Fed. Cir. 2003) ("In giving more weight to prior publications than to subsequent conclusory

statements by experts, the Board acted well within [its] discretion."). Based on the record before us, we are not persuaded that we should give the entirety of Dr. Kiaei's declaration no weight.

9. Summary

For the foregoing reasons, we are persuaded that Petitioner has established, by a preponderance of the evidence, that claims 9–12, 15–18, and 21 of the '412 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Milbrandt, Chang, Hwang, and ANSI T1.413.

E. Patent Owner's Motion to Exclude

Patent Owner filed a Motion to Exclude (Paper 27, "Motion"). Petitioner filed an Opposition to Patent Owner's Motion (Paper 31, "Opp."), and Patent Owner filed a Reply in support of its Motion (Paper 34). Patent Owner seeks to exclude Exhibit 1103 and Exhibit 1109.[7] Motion 2–4. As movant, Patent Owner has the burden of proof to establish that it is entitled to the requested relief. *See* 37 C.F.R. § 42.20(c). For the reasons stated below, Patent Owner's Motion to Exclude is *dismissed*.

Patent Owner moves to exclude Exhibits 1103 and 1109. Motion. Exhibit 1103 is styled "Declaration of Robert Short" and Exhibit 1109 is styled "FCC Filing for Alcatel Model 1000 ADSL Modem, 1999." Pet. Reply 5–6. Patent Owner argues that we should exclude Exhibit 1103 and Exhibit 1109 as hearsay, and that Exhibit 1109 should be excluded further as irrelevant. Motion 2–4. Although Dr. Kiaei cites Exhibits 1103 and 1109 in his second declaration (Ex. 1100 ¶¶ 7, 10, 39), we did not rely on Exhibits

[7] Patent Owner also moves to exclude Appendix B to Exhibit 1112, which it characterizes as a declaration of a Mr. Bader, on the grounds that it is irrelevant. There is, however, no Exhibit 1112 in this proceeding.

1103 or 1109, or on Dr. Kiaei's statements with respect to Exhibits 1103 and 1109 in rendering our decision. We did not and need not consider Exhibits 1103 and 1109. We have determined that Petitioner has demonstrated, by a preponderance of the evidence, that the challenged claims are unpatentable, without considering the specific objected to evidence or the portion of Dr. Kiaei's statements that discuss Exhibits 1103 and 1109. Accordingly, we *dismiss* Patent Owner's Motion to Exclude as moot.

F. Motion for Observations

Patent Owner also filed a Motion for Observations (Paper 29, "Obs."), to which Petitioner filed a Response (Paper 32, "Obs. Resp."). To the extent Patent Owner's Motion for Observations pertains to testimony purportedly impacting Dr. Kiaei's credibility, we have considered Patent Owner's observations and Petitioner's responses in rendering this Final Written Decision, and accorded Dr. Kiaei's testimony appropriate weight in view of Patent Owner's observations and Petitioner's response to those observations. *See* Obs. 1–15; Obs. Resp. 2–15.

III. CONCLUSION

Petitioner has demonstrated, by a preponderance of the evidence, that claims 9–12, 15–18, and 21 of the '412 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Milbrandt, Chang, Hwang, and ANSI T1.413.

IV. ORDER

Accordingly, it is

ORDERED that claims 9–12, 15–18, and 21 of the '412 patent are determined to be *unpatentable*;

FURTHER ORDERED that Patent Owner's Motion to Exclude is *dismissed*; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.,
Petitioner,

v.

TQ DELTA, LLC,
Patent Owner.

Case IPR2016-01009
Patent 8,238,412 B2

Before SALLY C. MEDLEY, TREVOR M. JEFFERSON, and MATTHEW R. CLEMENTS, *Administrative Patent Judges*.

CLEMENTS, *Administrative Patent Judge*.

DECISION
Denying Patent Owner's Request for Rehearing
37 C.F.R. § 42.71

I. INTRODUCTION

Pursuant to 37 C.F.R. § 42.71(d), TQ Delta, LLC ("Patent Owner") requests rehearing of our Final Written Decision (Paper 37, "Dec."). Paper 38 ("Req. Reh'g"). Specifically, Patent Owner submits that we overlooked arriving at a contradictory claim construction, overlooked a non-obviousness argument, and misapprehended the law regarding proper reply evidence and argument. Req. Reh'g *passim*.

For the reasons set forth below, Patent Owner's Request for Rehearing is *denied*.

II. STANDARD OF REVIEW

A party requesting rehearing bears the burden of showing that the decision should be modified. 37 C.F.R. § 42.71(d). The party must identify specifically all matters we misapprehended or overlooked, and the place where each matter was addressed previously in a motion, an opposition, or a reply. *Id*. With this in mind, we address the arguments presented by Patent Owner.

III. ANALYSIS

A. "During Showtime"

Patent Owner argues that our claim construction of "during showtime" in this proceeding to mean "during normal communications of a DSL receiver" contradicts our claim construction of the same term in *Cisco Systems, Inc. v. TQ Delta, LLC*, Case IPR2016-01007 ("the 1007 IPR"). Req. Reh'g 1–2. In the 1007 IPR, however, we construed "during Showtime" exactly the same as in this proceeding, i.e., to mean "during normal communications of a DSL transceiver." *Cisco Systems, Inc. v. TQ*

Delta, LLC, Case IPR2016-01007 (PTAB Oct. 27, 2017), Paper 38 ("the 1007 FWD") at 9. Thus, the construction of "during Showtime" in this proceeding is consistent with the construction of "during Showtime" in the 1007 IPR.

Patent Owner's issue is with a sentence in the claim construction analysis of "during Showtime" in the 1007 FWD that states, "[w]e are not persuaded by Patent Owner's negative construction, which excludes initialization from normal communication." The "not" in that sentence is a mistake. In an Errata mailed concurrently herewith, we correct that sentence in the 1007 FWD to read "[w]e are persuaded by Patent Owner's negative construction, which excludes initialization from normal communication."

Patent Owner also argues that we misapprehended its arguments and evidence that the prior art does not teach measuring signal-to-noise ratio ("SNR") "during Showtime" (i.e., not during initialization). Req. Reh'g. 2. Specifically, Patent Owner argues that we overlooked its explanation that Milbrandt's use of "during operation" in the context of measuring noise (*see, e.g.*, Ex. 1011, 12:58–63 ("[t]he noise information for a particular subscriber line **16** may be determined by measuring noise characteristics of a subscriber line **16** during operation")) means during modem training, which is not during "Showtime." *Id.* at 2–5. To the contrary, this argument was addressed explicitly at pages 36 to 37 of our Final Written Decision, where we explained that it is not persuasive because Milbrandt appears to be using "modem training" idiosyncratically to refer to a process that occurs "while providing data services to subscribers 12" and "during the normal course of operation of system 10," both which are "during Showtime" as we have construed that term. Dec. 36–37.

Patent Owner also argues that we misapprehended the parties' argument by finding that ANSI T1.413 teaches measuring "SNR during Showtime" whereas not even Petitioner alleged that ANSI T1.413 *measured* SNR during Showtime. Req. Reh'g 5. Patent Owner's argument appears to be based on our concluding sentence, which states that "we are persuaded by Petitioner's evidence that ANSI T1.413's teaching of 'SNR, as measured by the receivers' and 'externally accessible from the ATU-C' teaches the disputed limitation." Dec. 38. In an Errata mailed concurrently herewith, we correct that sentence to replace "the disputed limitation" with "Signal to Noise ratio."

Patent Owner also argues that we overlooked its argument that it would not have been obvious to combine Milbrandt with ANSI T1.413, and that Petitioner's Reply arguments about "bit swapping" were new. Req. Reh'g 6–8. We addressed this argument in our Final Written Decision and found it unpersuasive. Dec. 38–39. Petitioner's argument in Reply was not new. The Reply cites, *inter alia*, page 45 of the Petition (Pet. Reply 20–21), where the same argument was made. Specifically, the Petition states

> A person of ordinary skill in the art would have found it obvious to measure and calculate a signal-to-noise ratio on a per subchannel (sub-frequency) basis. Ex. 1009, p. 131. In particular, the discrete multitone (DMT) technology employed in Milbrandt's modems 42 and 60 allows for a variable number of bits to be transmitted on each subchannel. *Id*. Thus, the number of bits on any particular subchannel can be tailored to match the signal quality of that subchannel. *Id*. To determine how to spread the bits across the available subchannels (i.e., how many bits to transmit on each available subchannel), it would have been obvious to a person of ordinary skill in the art to measure the signal-to-noise ratio on a per subchannel basis. *Id*.

Pet. 45. Patent Owner is correct that this passage does not use the exact words "bit swapping" or "allocate[ing] bits," but the substance of the argument is the same.

B. Reply Evidence

Patent Owner argues that, in determining that Milbrandt's "subfrequency" teaches the recited "subchannel," we relied improperly on argument and evidence that were introduced only in Petitioner's Reply. Req. Reh'g 8–10. We disagree. Both our Final Written and the Petition rely upon Milbrandt's sub-frequency as teaching the recited "subchannel." *See, e.g.,* Pet. 34. Petitioner's Reply rebuts arguments raised in the Patent Owner Response. Petitioner was not required to anticipate and rebut, in the Petition, those arguments.

Patent Owner also argues that we overlooked or misapprehended its evidence showing that Milbrandt's sub-frequency is not the recited "subchannel." Req. Reh'g. 10–12. To the contrary, we addressed Patent Owner's arguments about V.90 and columns 344 of Figure 3 of Milbrandt, and found them unpersuasive. Dec. 26–30. Mere disagreement with the Board's conclusion is not a proper basis for rehearing. It is not an abuse of discretion to have made a conclusion with which a party disagrees.

Patent Owner also argues that we misapprehended evidence that ANSI T1.413 does not use "aggregate" to include individual values for each of the subchannels. Req. Reh'g. 12–13. As we explained in the Final Written Decision, Patent Owner's argument for claims 10 and 12 is not persuasive because it attacks ANSI alone, whereas Petitioner relies upon the combination of Milbrandt for teaching PSD "per subchannel" with ANSI for teaching PSD "based on a Reverb signal." Dec. 32–33. Thus, even

assuming that ANSI uses "aggregate" as Patent Owner contends, "that is not necessarily inconsistent with the claims, which" do not require the Reverb signal to be "per subchannel." *Id.* at 33.

C. Motion to Strike

Finally, Patent Owner argues that we abused our discretion by authorizing it to file only a listing of allegedly improper Reply arguments, by not authorizing it to file a motion to strike "showing ***why*** Petitioners' Reply arguments were improper and/or a motion to file a surreply showing why due process required that Patent Owner be given an opportunity to respond to Petitioner's new arguments," and by addressing its listing in a footnote in the Final Written Decision. Req. Reh'g. 13–15 (emphasis original) (citing *Redline Detection, LLC v. Star Envirotech, Inc.*, 811 F.3d 435 (Fed. Cir. 2015); *Ultratec, Inc. v. CaptionCall, LLC*, 872 F.3d 1267 (Fed. Cir. 2017)).

The cases relied upon by Patent Owner do not stand for the proposition that we must authorize a motion to strike and/or a surreply. *Redline* involved a denial of Petitioner's Motion to Submit Supplemental Information and, on appeal, the Federal Circuit held that the denial did not constitute an abuse of discretion. *Redline*, 811 F.3d at 443–449. *Ultratec* involved a denial of a Patent Owner authorization to file a Motion to Submit Supplemental Information in the form of sworn inconsistent testimony. *Ultratec*, 872 F.3d 1269–1271. The Federal Circuit held that "[t]he Board abused its discretion when it refused to admit and consider Mr. Occhiogrosso's trial testimony and when it refused to explain its decision. *Ultratec*, 872 F.3d at 1275.

Here, in contrast, Patent Owner was not denied an opportunity to submit evidence. Instead, Patent Owner was granted the opportunity to identify allegedly new arguments and evidence in Petitioner's Reply, and we considered the identified portions when reaching our decision. Although the "listing" format required Patent Owner to be efficient in its identification and required Petitioner to be efficient in its responsive paper, these papers provided "the information necessary to make a reasoned decision" (*Ultratec*, 872 F.3d at 1273) about whether the arguments and evidence raised in reply were outside the scope of a proper reply. Accordingly, we are not persuaded that we abused our discretion by denying Patent Owner authorization to file a Motion to Strike and/or Sur-Reply, or by determining, in the Final Written Decision, that "Petitioner's arguments and evidence that Patent Owner objects to (Paper 20, 1–2) are not beyond the proper scope of a reply because we find that they fairly respond to Patent Owner's arguments raised in Patent Owner's Response" (Dec. 25 n.5).

II. ORDER

Accordingly, it is it is ORDERED that Patent Owner's Request for Rehearing is *denied*.

For PETITIONER:

David L. McCombs
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.,
Petitioner,

v.

TQ DELTA, LLC,
Patent Owner.

Case IPR2016-01009
Patent 8,238,412 B2

Before SALLY C. MEDLEY, TREVOR M. JEFFERSON, and MATTHEW R. CLEMENTS, *Administrative Patent Judges*.

CLEMENTS, *Administrative Patent Judge*.

ERRATA

The panel modifies our Final Written Decision issued on October 26, 2017 (Paper 38) as follows: On pages 36–37 of the Final Written Decision, the sentence "Even assuming that Patent Owner is correct about SNR margin, which we need not decide, we are persuaded by Petitioner's evidence that ANSI T1.413's teaching of 'SNR, as measured by the receivers' and 'externally accessible from the ATU-C" teaches the disputed limitation' is changed to "Even assuming that Patent Owner is correct about SNR margin, which we need not decide, we are persuaded by Petitioner's evidence that ANSI T1.413's teaching of 'SNR, as measured by the receivers' and 'externally accessible from the ATU-C' teaches Signal to Noise ratio." Specifically, "the disputed limitation" is changed to "Signal to Noise ratio." In all other respects, the Final Written Decision is unchanged.

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